REMARKS

Claims 1-55 are pending and claims 56-73 have been withdrawn.

Claims 8, 11 and 13-55 stand rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which application regards as the invention.

Claims 8, 12, 13, 19-21, 40 and 43 contain the term "dry" and claims 10-11, 39 and 42 contain the term "wet." The examiner asserts that these terms are not defined by the claims and the specification does not provide a standard for ascertaining the requisite degree. However, in the Detailed Description, para. [0045] states that "a cation exchange membrane, even when in the proton form, is not effectively acidic if the membrane is *dry, that is neither solvated or hydrated*." Accordingly, the Applicant asserts that the specification does in fact provide a standard for ascertaining the scope of the terms "dry" and "wet." If a membrane is neither solvated or hydrated, then it is dry. Conversely, if a membrane is either solvated or hydrated, then it is wet. A person having ordinary skill in the art is knowledgeable about the scope and meaning of "solvated" and "hydrated." Reconsideration and withdrawal of the rejection is requested.

Claims 1, 2, 4-13, 16-24, 27-32 and 39-45 stand rejected under 35 U.S.C. 102(b) as being anticipated by Gonzalez-Martin et al. (U.S. Pat. 6,149,810). Gonzalez-Martin discloses a proton exchange membrane (PEM) having internal passages (i.e., a "tubulated membrane") of approximately 1 to 9 mils diameter used as a means to hydrate the membrane. (Gonzalez-Martin, col. 12, lines 39-47). A membrane and electrode assembly ("M&E assembly" or simple "MEA") may be fabricated by applying electrodes to one or both sides of the tubulated membrane after the membrane has been hot pressed (Gonzalez-Martin, col. 17, lines 35-40). Such an MEA may be utilized in fuel cells, electrolyzers, electrochemical hydrogen and oxygen pumps. (Gonzalez-Martin, col. 1, lines 15-19). In a depolarized ozone electrolysis cell, an electrocatalyst layer of lead dioxide may be formed on a porous, non-corroding, electronically

conducting support material, such as sintered titanium particles. (Gonzalez-Martin, col. 20, line 60 to col. 21, line 12).

The basic process of forming a tubulated membrane is initially described as follows:

> A PEM membrane with internal passages can be formed in a variety of ways. Briefly, the technique involves pressing ionically conducting material around a plurality of removable elements at sufficient temperature and pressure to fuse the material into a single membrane. After the material is fused, the elements are removed from the membrane to leave a passage for fluid flow. The removable elements may take any shape or form so long as the passages provide a substantially uniform flow of fluid throughout the entire membrane. The preferred removable elements are substantially parallel wires or tubes. However, it may be possible to form the passages around elements which are later removed through dissolution.
> (Gonzalez-Martin, col. 12, lines 48-60).

Gonzalez-Martin further discloses that a tubulated membrane may be pressed while the perfluorinated sulfonic acid (PFSA) membrane is in the proton form (Gonzalez-Martin, col. 13, line 61 to col. 14, line 3) or in the form of the thermoplastic sulfonyl fluoride precursor to PFSA (Gonzalez-Martin, col. 14, lines 4-13). With respect to the latter (i.e., pressing a tubulated membrane in the thermoplastic sulfonyl fluoride form), Gonzalez-Martin says that "[a]fter pressing, the membrane is hydrolyzed with a 25% sodium hydroxide solution at 85° C *to release the membrane from the wires*." (Gonzalez-Martin, col. 14, lines 9-11; *emphasis added*). "The ionomer is then treated with an acid, such as sulfuric acid, to *convert it to the proton form for use*." (Gonzalez-Martin, col. 14, lines 11-13; *emphasis added*). The Applicant emphasizes that Gonzalez-Martin teaches the use of sodium hydroxide only for the purpose of converting a membrane from the thermoplastic sulfonyl fluoride form to the sodium form in order to release the membrane from the wires that define the passages. Furthermore, Applicant points out that Gonzalez-Martin also teaches that the membrane should then be treated with an acid to convert the membrane to the proton form for use. Although Gonzalez-Martin teaches the brief conversion of a membrane from a thermoplastic sulfonyl fluoride form to a sodium form for the purpose of releasing wires, there is no teaching that the membrane is ever in the sodium form during contact with one or more electrodes.

Gonzalez-Martin goes on to teach that the MEA and the passages through the MEA may be formed in a single process step. (Gonzalez-Martin, col. 14, lines 57-61). However, the only example of a single process step uses the process conditions associated with a PFSA membrane in the proton form. (Gonzalez-Martin, col. 14, lines 62 to col. 15, line 4). Gonzalez-Martin includes no express or inherent disclosure of an MEA that includes an electrode in contact with a membrane in the sodium form.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Therefore, Applicant asserts that claim 1 is not anticipated. Reconsideration and withdrawal of the rejection is requested.

Regarding claims 13, 16-24, 27-32 and 39-45, the examiner asserts that Gonzalez-Martin anticipates the method of "providing a membrane and electrode assembly having one or more electrocatalysts in intimate contact with a cation exchange membrane in a dry proton form during a period without an electrical current passing through the membrane and electrode assembly" (See claim 13), because Gonzalez-Martin discloses the use of a solid polymer electrolyte (SPE) membrane rather than a liquid electrolyte. This interpretation of claim 13 is inconsistent with the present specification, which deals only with solid polymer electrolyte membranes, such as proton exchange membranes, but states that these membranes may be either wet or dry. Therefore, the term "wet" should not be interpreted as meaning that a liquid electrolyte is used.

Furthermore, Gonzalez-Martin's disclosure that "the tubulated membrane is allowed to dry for several hours" must be read in context of the whole paragraph, which describes how to form a tubulated membrane by applying a recast film, such as spraying a 5% solution of PFSA onto PFSA tubes. In this context, the reference to "drying" means that the recast film is allowed to dry. Because the formation of a membrane with recast film must be completed prior to applying any electrode materials, this disclosure involves a membrane, but not a completed MEA. Accordingly, the cited passage does not disclose "one or more electrocatalysts in intimate

contact with a cation exchange membrane in a dry proton form." Reconsideration and withdrawal of the rejection is requested.

Claims 3, 14, 15, 25 and 26 stand rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Gonzalez-Martin et al. (U.S. Pat. 6,149,810). The Applicant reasserts the arguments made above with respect to independent claims 1, 13 and 24. More specifically, the Applicant asserts that Gonzalez-Martin does not disclose an MEA that is identical to the claimed MEA, and that Gonzalez-Martin includes no express or inherent disclosure of an MEA that includes an electrode in contact with a membrane in the sodium form. Reconsideration and withdrawal of the rejection is requested.

Claims 33-38 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Gonzalez-Martin et al. (U.S. Pat. 6,149,810). Claim 33-38 depend from claim 31, which dependes from claim 30, which ultimately depends from independent claim 24. Applicant draws attention to the limitation of claim 30, including the step of "converting the cation exchange membrane from the sulfonyl-fluoride form to an alkali metal cation form." It should be recognized that "the cation exchange membrane" finds antecedent basis in the limitation of "providing a membrane and electrode assembly having one or more electrocatalysts in intimate contact with a cation exchange membrane in a sulfonyl-fluoride form" found in claim 24. Accordingly, these claims are directed to converting a cation exchange membrane, which is in an MEA with one or more electrocatalysts in intimate contact therewith, from the sulfonyl-fluoride form to an alkali metal cation form. Gonzalez-Martin makes no such disclosure or suggestion, as previously discussed. Specifically, Gonzalez-Martin teaches the use of sodium hydroxide only for the purpose of releasing the membrane from the wires that define the passages. Gonzalez-Martin does not teach, show or suggest the invention of the present claims. Reconsideration and withdrawal of the rejection is requested.

Claims 46-55 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Gonzalez-Martin et al. (U.S. Pat. 6,149,810) in view of Nakamatsu et al. (Japanese Publication 06-081183). Claim 46 is set out below for convenient reference:

> 46. (currently amended) A method, comprising:
> passing electrical current through a membrane and electrode assembly having one or more electrocatalysts in intimate contact with a cation exchange membrane in a hydrated proton form; and then
> supplying an alkali metal hydroxide solution to [[a]] the membrane and electrode assembly under an electrical potential; and then
> removing [[an]] the electrical potential from across the membrane and electrode assembly, wherein the proton exchange membrane is converted from the hydrated proton form to the alkali metal cation form.

The examiner asserts that Nakamatsu et al. teaches the application of a protective voltage to an electrode, and that Gonzalez-Martin teaches the remainder of the claim limitations (referring to the examiner's previous comments). However, claim 46 includes three steps that must be taken in order. As previously discussed, Gonzalez-Martin teaches the use of sodium hydroxide only for the purpose of releasing the membrane from the wires that define the passages. Such wire removal occurs only during the preparation of the tubulated membrane for use. (Gonzalez-Martin, col. 14, lines 9-13). There is no disclosure or suggestion in Gonzalez-Martin, or Nakamatsu et al. for that matter, of "passing electrical current through a membrane and electrode assembly having one or more electrocatalysts in intimate contact with a cation exchange membrane in a hydrated proton form; and then supplying an alkali metal hydroxide solution to a membrane and electrode assembly under an electrical potential". (Claim 46; *emphasis added*). Nakamatsu does not teach or suggest the foregoing limitations or the limitation of "removing an electrical potential from across the membrane and electrode assembly." In fact, Nakamatsu teaches the use of a protective voltage in order to preserve the electrode material, and would not have any reason to supply an alkali metal hydroxide solution to the MEA. The invention of claim 46, supplies the alkali metal hydroxide solution to the MEA under electrical potential, thereby converting the membrane to the alkali metal form, so that the electrical potential can be removed without damage to the electrodes. The combination of

Gonzalez-Martin and Nakamatsu et al. does not teach, show or suggest the claimed invention. Reconsideration and withdrawal of the rejection is requested.

The examiner makes a brief reference to Plowman et al. (U.S. Pat. 5,654,109) as being considered pertinent to Applicant's disclosure. The Applicant asserts that Plowman et al. used sodium hydroxide merely to convert the sulfonyl fluoride form of the PFSA membrane to the sodium form, before immediately treating the membrane with acid to further convert the membrane to the proton form. Plowman expresses no teaching or suggestion of the presently claimed invention. Furthermore, Plowman's use of sodium hydroxide is limited to membranes, where the membranes are converted to the proton form before being used to form an MEA.

Applicant believes this reply is fully responsive to all outstanding issues. If this is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned. In the event there are additional charges in connection with the filing of this Response, the Commissioner is hereby authorized to charge the Deposit Account No. 500714/LYNN-0127 of the firm of the below-signed attorney in the amount of any necessary fee.

Respectfully submitted,

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